DRINKING WATER TEST AT WEST VALLEY WATER DISTRICT SITE

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WVWD Test

- MIH Water is currently partnering with WVWD to conduct challenge testing for conditional acceptance of our product by CDPH for drinking water treatment. We recently completed our challenge test on August 14th 2013 and has submitted our challenge testing report on August 19th,2013.
- Previously we have performed a one year drinking water demonstration under the EPA Site program.

Bioreactor Basics

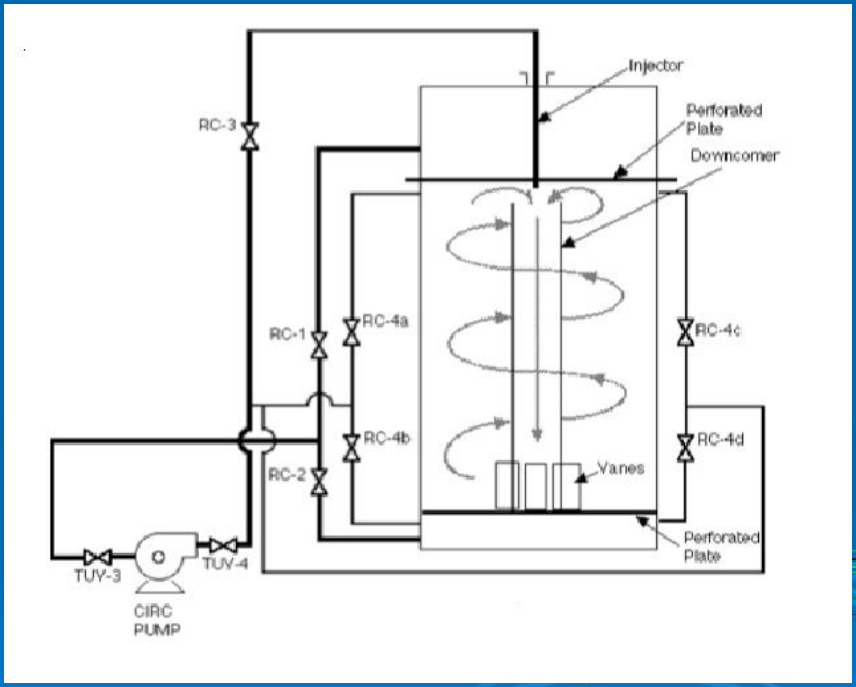
- Bacteria consume oxygen (reduction).
- The more active bacteria in a reactor the more the efficiency improves.
- Improved efficiency reduces operational cost with better electron donor use, reduced footprint, lower energy and reduced waste.
- The use of a constantly stirred reactor with a substrate for holding the bacteria at maximum density is the solution to the nitrate removal problem.
- The control system is the key to safe operation.

Bio-system Issues

Issue	Resolution
Efficiency	Continuously stirred reactor
Startup waste water and cyclic operation	System recycle
Solid waste production	Minimize electron donor
Sulfate reduction	Operate at a positive ORP
Off spec. discharge	Control system design

Hall Reactor

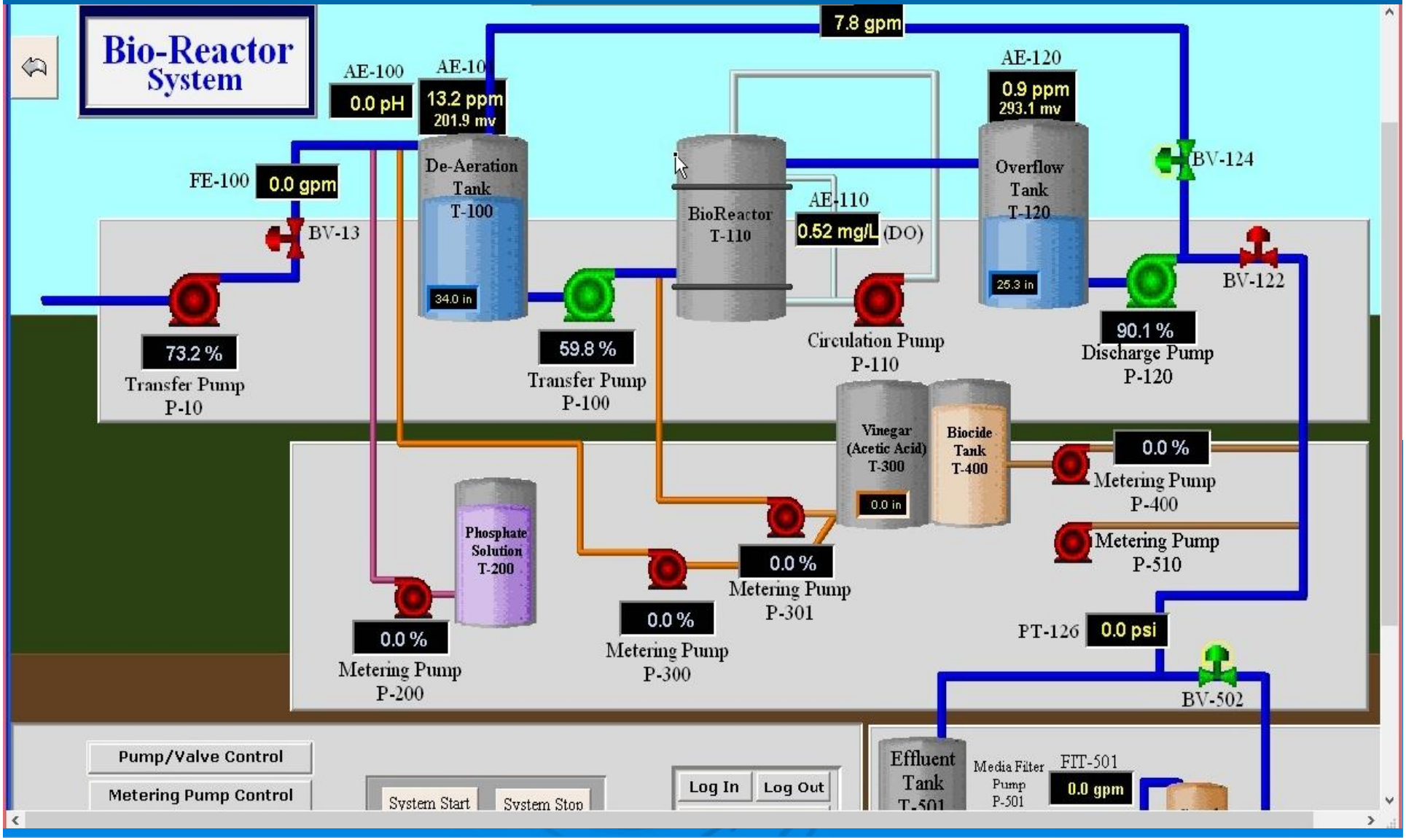
- Circulation driven by a pump
- Note circulation pattern
- Carrier in circulation; bacteria on the carrier
- Highest concentration of active bacteria in reactor



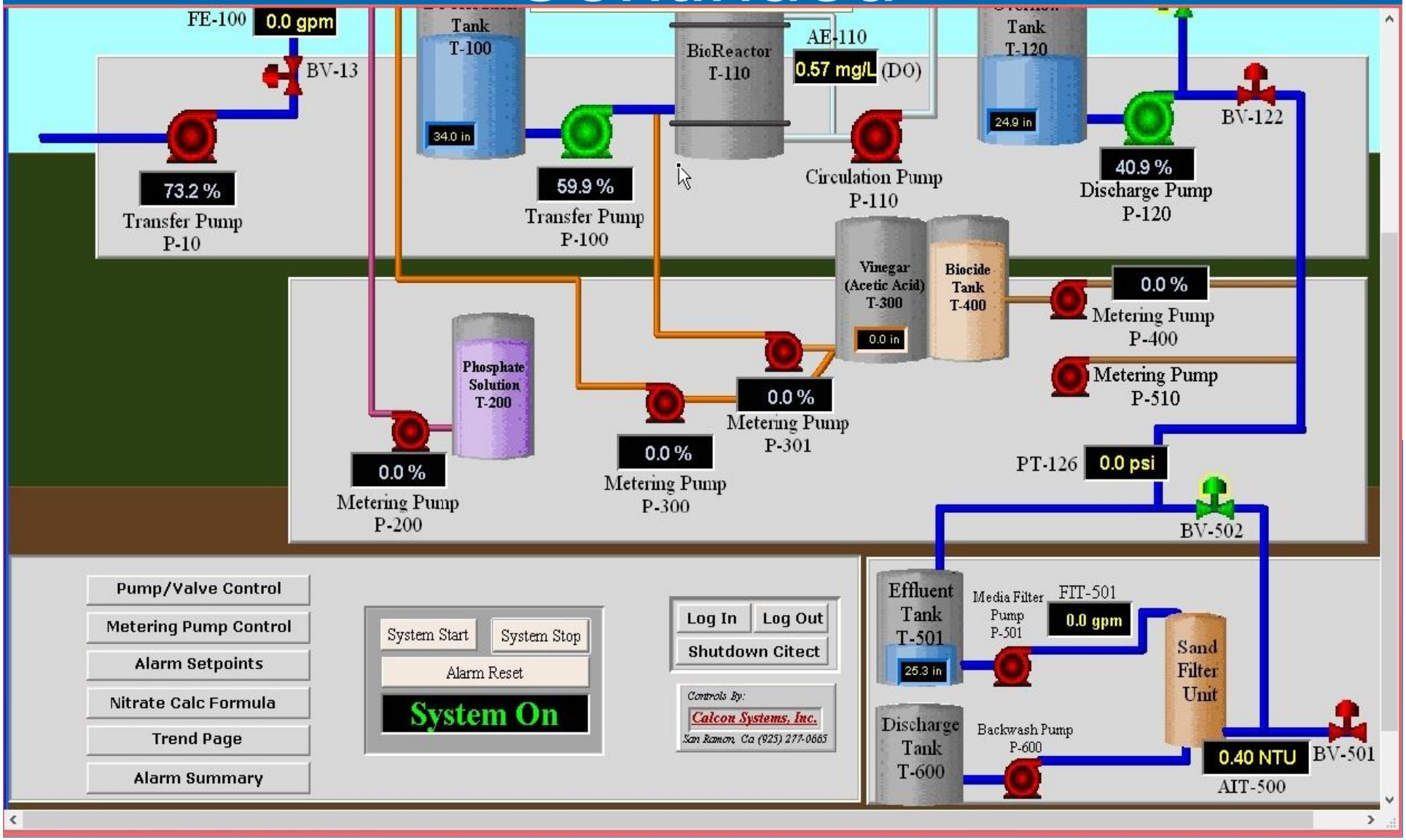
System Control

- When system fails unit goes in safe mode
- Alarm notification sent to operators
- Remote control operation
- No water exceeding mcl’s leaves the system
- Recycle of water allows for fast recovery and the prevention of sulfate reduction
- Post nitrate treatment control critical

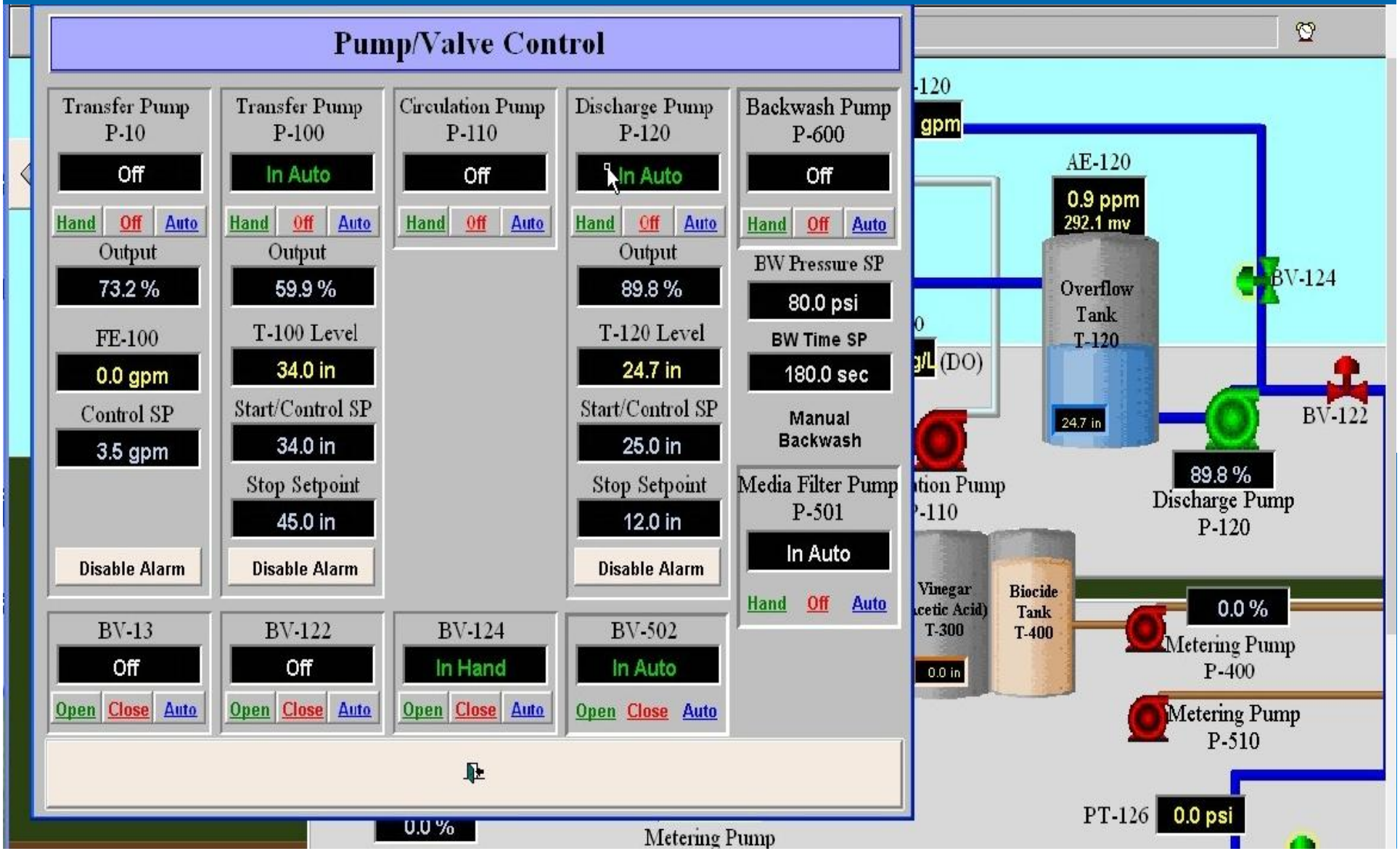
System at WVWD



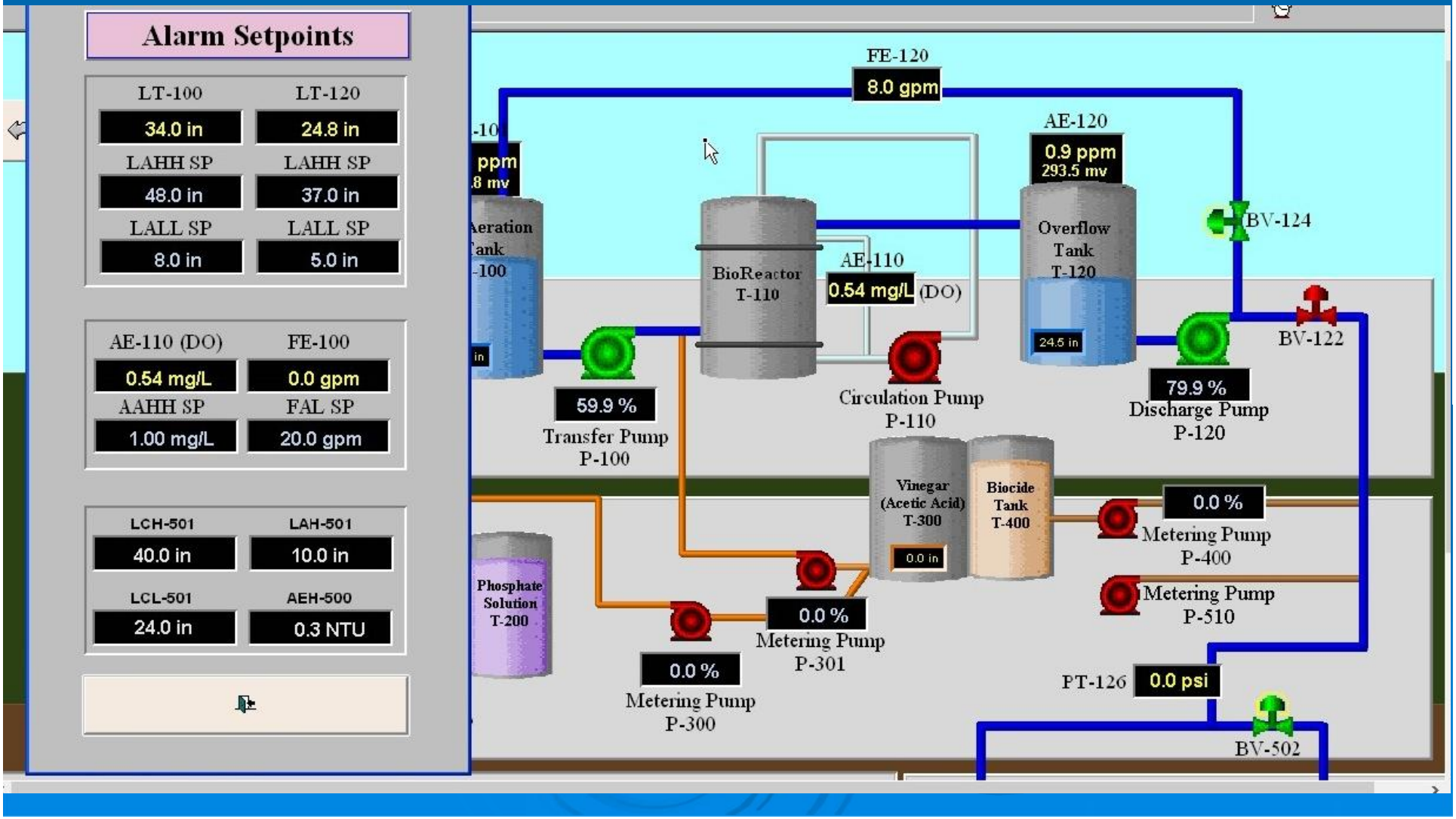
System at WVWD Continued



Pump and valve control



Alarm Setpoints



Full Scale System

- This is a Hall Reactor full Scale System
- Arrows pointing at two Hall Reactors
- System is capable of treating nitrates, perchlorates, hex-chrome and selenium

Fifteen Years of Operating Experience

- Bendina:20 gpm NO_3
- EAFB 5gpm CLO_4
- California site 120 gpm NO_3,CLO_4, HEX-CR, Se
- Rialto 100 gpm NO_3, CLO_4
- Twenty plus pilots
- Remote control
- No odor, indoor operation
- Demonstrated to work on RO waste streams
- Minimum waste
- Small system design possible

Cost

- Cost is a function of flow and concentration
- Bio-systems are consistently the lowest cost system to build and operate
- Basic denitrification $90-$200/acre-ft (non-potable)
- Post treatment controls the system cost
  - Efficiency, electron donor, disinfection, coagulant, and filtration effect the turbidity
- Turbidity measurement controls the discharge from the system

Action Items

- Complete any required additional tests as required by the CDPH
- Secure acceptance of the system for direct drinking water treatment
- Install the system at sites with high levels of nitrate as already identified and discussed with a number of potential system owners.

Site Picture